National Antimicrobial Resistance Monitoring System (NARMS), 1996-2001: Emerging Multidrug and Clinically Important Resistance in Enteric Bacteria

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Background: NARMS is a collaboration between CDC, participating public health laboratories, and the FDA's Center for Veterinary Medicine. In 1996 NARMS began to monitor antimicrobial resistance of non-Typhi *Salmonella.* Testing of *Campylobacter* and *Salmonella* Typhi was added in 1997 and 1999, respectively. NARMS plays a key role in identifying and tracking multidrug-resistance and resistance to clinically important antimicrobials.

Methods: Laboratories forwarded every tenth non-Typhi *Salmonella* and every *Salmonella* Typhi to CDC for susceptibility testing. Partial range minimum inhibitory concentrations (MICs) were determined for 17 antimicrobials using a semi-automated broth microdilution system (Sensititre®). The nine state public health department laboratories participating in FoodNet also forwarded one *Campylobacter* isolate per week to CDC. Isolates were speciated and susceptibility tested for MICs to 8 antimicrobials via E-test®.

Results: Over the past six years, NARMS has observed several key findings. Among non-Typhi *Salmonella*, three multidrug-resistant strains accounted for a substantial proportion of resistance. In 2001, although 28% (394/1419) of non-Typhi *Salmonella* were resistant to ≥ 1 agent, 7% (96/1419) were *S.* Typhimurium ACSSuT; 1% (15/1419) were *S.* Typhimurium AKSSuT; and 2% (31/1419) were *Salmonella* Newport MDR-AmpC. There has also been an increase in the proportion of resistance to quinolones and 3rd generation cephalosporins. The percentage of non-Typhi *Salmonella* resistant to ciprofloxacin was 0.2% (3/1419) in 2001, whereas no resistance was found in 1996. Resistance to ceftriaxone was 2% (34/1419) in 2001 compared to 0.1% (1/1326) in 1996. The percentage of *Salmonella* Typhi isolates that were nalidixic acid-resistant was 30% (59/197) in 2001 compared to 19% (31/166) in 1999. The percentage of *Campylobacter* isolates that were resistant to ciprofloxacin was 19% (75/384) in 2001 compared to 13% (28/217) in 1997.

Conclusions: NARMS surveillance has identified prevalent strains of multidrug-resistant *Salmonella* and resistances to clinically important antimicrobials in both *Salmonella* and *Campylobacter*. Monitoring antibiotic resistance will contribute to developing prevention strategies to combat resistant bacteria.